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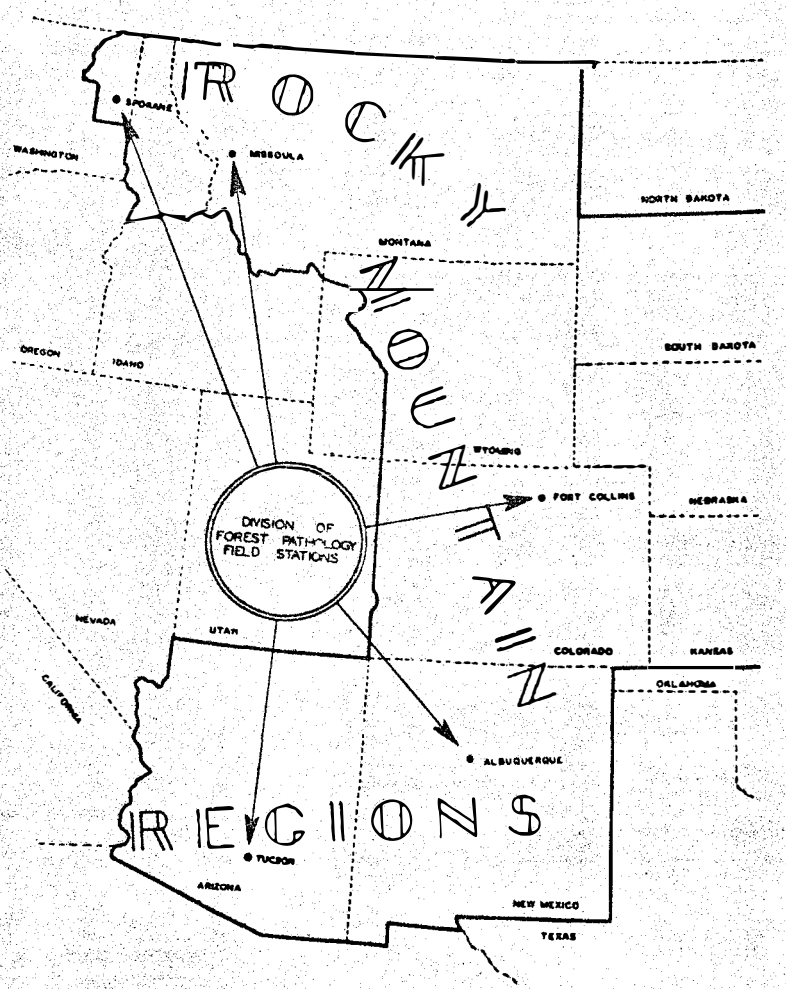
THE FOREST DISEASE SITUATION

IN THE

ROCKY MOUNTAIN REGIONS

1951



UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH ADMINISTRATION

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

DIVISION OF FOREST PATHOLOGY

MAY 1952

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THE FOREST DISEASE SITUATION IN THE ROCKY MOUNTAIN REGIONS in 1951

Division of Forest Pathology
Albuquerque, New Mex.
May 1952

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THE FOREST DISEASE SITUATION IN THE ROCKY MOUNTAIN REGIONS

IN 1951

INTRODUCTION

Organization of the Division of Forest Pathology in the Rocky Mountain Regions

Forest disease investigations and surveys within the Rocky Mountain Regions are conducted by five field stations of the Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering. These stations are located at Albuquerque, New Mexico, Fort Collins, Colorado, Missoula, Montana, Spokane, Washington, and Tucson, Arizona. The station at Albuquerque has been in operation since 1913 and is staffed with three forest pathologists. The stations at Missoula, Montana and Fort Collins, Colorado were established in 1950 and 1951, respectively, and are each staffed with one pathologist. A one-man station at Spokane was established in 1950 as headquarters for the western white pine pole blight survey. The station at Tucson, with one pathologist, was opened in 1940 for the specific purpose of investigating a stem rot disease of the Giant Saguaro (Carnegia gigantea) and related cacti. Addresses are given in the Appendix to this report. Obviously, the work outlined here could not have been accomplished without the help of a large number of cooperators in Federal; State, and private work, a partial list of whom is given in the Appendix.

Forest diseases and the problems they present

The Rocky Mountain Regions include a variety of timber species and types, each with its own peculiar set of disease problems. The causes of most of the common diseases are known. In a few cases, satisfactory control methods have been developed; in others, control is feasible but impractical under current economic conditions. In the vast majority of the diseases, research has not been adequate to even suggest control measures.

A constant challenge to the forest pathologist is the appearance of new and threatening diseases. Search for the cause of such diseases may be difficult and prolonged; control problems may take even longer to solve completely. Trees are slow-growing crops so that time is an important factor in any type of forest research. Constant vigilance for new and threatening diseases, followed by prompt action, should insure the Region against ravages approaching those of the chestnut blight in the East. Reports of unexplained dying or disease should be sent to our Forest Pathology field stations.

Disease is regarded as any abnormal condition in the tissues or physiology of trees that (1) shortens their life, (2) slows their

growth, (3) impairs their form or value, or (4) destroys wood that has been formed. Insects and other animals may also damage trees, and these problems are handled by entomologists and zoologists, respectively; when insects or other animals are involved with an infectious disease, a cooperative research program is undertaken with the Division of Forest Pathology.

Diseases may be classified in two broad groups: "infectious" and "noninfectious". Infectious diseases are caused by pathogenic organisms which, by passing from one tree to another, can bring about an increasing number of diseased individuals. Infectious diseases are caused by fungi, bacteria, viruses, and parasitic seed plants. Noninfectious diseases are the result of nonliving influences; they may be caused by unfavorable weather, improper soil, or contaminating elements in water or air.

From the ecological standpoint, there are two broad classes of disease: viz, endemic and epidemic. The endemic ones are a normal part of the unmanaged forest complex; they do not result in the sudden loss of whole stands or species but the toll they take may be startling in the course of a forest generation. These losses can often be reduced through improved silvicultural and management practices. Epidemic diseases may result in very extensive losses of affected stands, forests, or even entire species. A native endemic disease may, under particularly favorable conditions, become epidemic; an introduced organism may find our conditions particularly well suited to its propagation and spread and our forest species with little or no resistance to it. Control of epidemic diseases may involve drastic measures in order to stamp them out or check their spread. Chestnut blight and white pine blister rust are examples of foreign diseases that have reached epidemic proportions.

If we were to classify forest tree diseases on the basis of the nature of their damage, perhaps three broad categories would suffice. (1) Killing diseases might be regarded as those which result in abnormal and sudden mortality. Since most diseases shorten the life of trees, the classification cannot be taken too literally. (2) Diseases that lower values or reduce volumes include cankers, galls, excessive forking, or other deformities that result in degrade or poor utilization. Leaf blights, root rots, and other diseases reduce periodic increment and ultimate yields. (3) Diseases that degrade or destroy accrued volume apply generally to the heart rots and include to a lesser extent the sap rots, which invade fire, lightning, and other scars in living trees. The decays and stains that affect salvage of dead timber are also in this category.

PROJECTS OF MAJOR IMPORTANCE IN 1951

Pole blight of western white pine in northern Idaho and adjacent Washington and Montana

Pole blight is a killing disease of unknown cause; it has resulted in serious losses in pole-size western white pine, i.e. trees 40-100 years of age. It is widespread in the white pine stands of western Montana, northern Idaho, and eastern Washington. It is common in the Interior of British Columbia and during 1951 an isolated spot of the disease was reported on Vancouver Island. It has not been reported as yet from the vast white pine forests of the Clearwater basin in Idaho.

The most easily recognized early symptoms of the disease are reduced terminal growth, coupled with yellowish short needles in the upper crown. As the disease progresses, more and more of the crown becomes affected until most if not all of the foliage is markedly yellow, short, and sparse. Finally the tree dies. Death of severely blighted, and weakened trees may be hastened by the attacks of secondary insects. The stems of the pole blighted trees are frequently characterized by cankers (patches of dead bark), resinosis (pitch flow), and flat faces (areas of cambium that have ceased to lay down new wood for several years). Often these symptoms are preceded by a period of markedly reduced radial growth.

Investigations are now in progress on the cause and nature of the disease and on possible control measures, such as removal and poisoning of diseased trees as a means of checking intensification and spread. This work is a part of an integrated program in which the University of Idaho, the Northern Rocky Mountain Forest and Range Experiment Station, the Dominion Laboratory of Forest Pathology, and the Division of Forest Pathology are all participating. In addition, the program has been aided through most helpful cooperation from the Northern Region of the U. S. Forest Service, the Office of Blister Rust Control at Spokane, Washington, the Forest Insect Laboratory at Coeur d'Alene, Idaho, the Department of Plant Pathology of Washington State College, the North Idaho Forestry Association, and the Clearwater Protective Association.

For the past four years the Division of Forest Pathology has been actively engaged in a research and survey program in an attempt to determine the cause and nature of the disease. Research has been directed particularly to the question of whether or not pole blight is infectious. Airplane and ground surveys conducted in 1949, 1950, and 1951 indicate that it is intensifying and spreading and that it now occurs on 10 percent of the 750,000 acres of pole-sized white pine in northern Idaho, eastern Washington, and western Montana. The survey was conducted on funds provided under the Forest Pest Control Act.

The cooperative research program will be continued during 1952. Current results have been and will continue to be reported in the Quarterly Pole Blight Research Progress Report assembled and distributed by the School of Forestry, University of Idaho, Moscow, Idaho.

Thus far, a number of suspected fungi have been used in inoculation experiments and to date have failed to produce typical symptoms of pole blight. One fungus, a species of Leptographium, produces cankers similar to those often found on the trunks of blighted trees but a systematic analysis of naturally diseased stems suggests that the cankers may be secondary rather than primary symptoms. Similarly, experiments to determine whether or not a virus is involved are as yet inconclusive. Soil analyses and fertilizer tests indicate that there is no correlation between incidence of the disease and site quality or soil types. Tissue analyses, with both conventional methods and radioactive isotopes, indicate that diseased trees differ from healthy ones in the proportion of certain minerals. These, however, do not appear to be correlated with excesses or deficiencies in the soil. The soil and isotope studies have been made exclusively by the University of Idaho.

Deterioration of beetle-killed spruce in Colorado

In the course of the past decade the Engelmann spruce beetle (Dendroctonus engelmanni) has killed over 4 billion board feet of spruce in Colorado. In 1951, a study was started to determine the rate of deterioration of this dead timber and to provide other information that will assist in meeting the tremendous salvage problem that has developed. This work was undertaken in cooperation with the U. S. Forest Service, Rocky Mountain Region, and the Rocky Mountain Forest and Range Experiment Station. Valuable assistance was also given by the Forest Insect Laboratory and Colorado A. & M. College, both at Fort Collins, Colorado.

Four study areas were established on the Routt and White River National Forests. On these areas more than 200 trees were cut, dissected, and measured; also, a large number of specimens were taken for fungus isolations and reference purposes. Preliminary analyses indicate that bluestain is established before or shortly after the trees are killed and that 20 to 40 percent of the cubic volume is rapidly invaded. The stain is caused by a species of the fungus Leptographium which is brought in by the beetles. It discolors the wood but does not adversely affect its strength nor its utility for pulp. There is also an indication that sap rotting fungi may destroy from 4 to 6 percent of the cubic volume in trees that have been dead 8 to 10 years. The losses through windfall were negligible in this period. As windfall increases, the loss can be expected to increase at an accelerated rate.

Of 262 samples taken from the dissected trees, 155 yielded rot fungi that could be classified; 40 additional cultures have not been identified at this writing. Following is the list of known wood-rotting fungi that play some part in the deterioration of beetle-killed spruce and lodgepole pine.

Heart Rots

White butt rots: Armillaria mellea, Stereum sulcatum, Fomes nigrolimitatus, Polyporus circinatus, Poria ferrugino-fusca, Pholiota adiposa.

Brown butt rot: Coniophora cerebella.

White (pocket) trunk rot: Fomes pini.

Brown trunk rots: Stereum sanguinolentum, Trametes serialis, Peniophora luna.

Sap Rots

Brown sap rot: Fomes pinicola.

White sap rots: Polyporus abietinus, Corticium sp., Poria sp. Peniophora sp.

Four study areas have been selected; re-examinations and additional dissections will be made at 5-year intervals for the next 20 years, if necessary. In the meantime, additional observations and systematic studies will be undertaken to assist in the salvage problem. The need for future work will depend to a large extent on the demand for dead spruce as pulpwood.

Mistletoe control in the Southwest

Grand Canyon National Park

In 1949 a project for the control of dwarfmistletoe (Arceuthobium vaginatum) on ponderosa pine was begun in the Grand Canyon National Park, Arizona. The work was performed with funds allotted to the National Park Service under the Forest Pest Control Act. Technical supervision was given by the Division of Forest Pathology, on both regular and Pest Control Act funds.

The area under treatment involved about 1100 acres of land bordering the scenic drive along the South Rim where heavy infections of mistletoe threatened the ponderosa pine stand with eventual extinction. The program calls for completion of the initial control work by 1952, after which follow-up operations will be undertaken as required. Follow-up is essential; this parasite often develops in the bark of its host for several years before putting out shoots, which are the only visible indications of the presence of mistletoe, and it is inevitable that many infections will be missed in a single control operation.

Wherever possible, mistletoe was pruned out of the infected trees, only in the hopeless cases were the trees felled or poisoned. While some of the felled trees were salvaged for lumber, fire wood, trail and gully barriers, and rustic structures, most of the debris resulting from the control operation had to be disposed of at a direct cost. The use of a portable chipper during 1951 not only has simplified the physical

disposal problem but also has permitted a maximum return of organic matter to the soil, with a minimum fire hazard and degree of unsightliness.

There is every reason to believe that with substantial mistletoe reduction the future ponderosa pine stands will enjoy increased vigor and thereby become less susceptible to loss from epidemics of insects or disease. The Division has established a number of permanent study plots from which the effectiveness of the control measures used can be determined more exactly in the future.

Bryce Canyon National Park

During 1951, a preliminary survey of dwarfmistletoe on ponderosa pine was completed in Bryce Canyon National Park, Utah. This survey was conducted on regular funds of the Division of Forest Pathology, in cooperation with the National Park Service, both Region 3 and Bryce Canyon National Park. Although Bryce Canyon lies outside the Rocky Mountain territory, for convenience the project was handled from Albuquerque.

A 250-acre area under consideration for mistletoe control was sampled by means of 70 line plots each 1/4 acre in area. From the sample it appeared that initial control would involve the destruction of 2850 trees and the pruning of 1650 more, leaving about 8500 mistletoe-free trees at the completion of the operation. It was estimated that about 50,000 board feet of low grade lumber could be salvaged from the mistletoe-infected trees that would be cut.

Mescalero-Apache Indian Reservation

During March and April 1951, a preliminary survey of dwarfmistletoe was conducted on 68,800 acres of ponderosa pine forest under management in the Mescalero-Apache Indian Reservation. This work was done on regular funds, in cooperation with the Bureau of Indian Affairs, both the Albuquerque Area Office and the Mescalero-Apache Indian Reservation.

The area sampled was about 4/10,000 of the total acreage where mistletoe is a management problem. From this small beginning it appeared that mortality increased directly with the abundance of mistletoe. In terms of merchantable stems, mortality during the past 15 years (estimated by the condition of dead trees) was determined to be 26 percent on the mistletoe-infected plots in contrast with 9 percent on the healthy ones. Volume losses attributable to mistletoe were somewhat less since the heaviest infections were on the upper slopes where both healthy and infected trees were relatively small. The infected plots showed a volume loss of 24 percent in contrast with 18 percent on the healthy ones in the past 15 years.

Authority for a more complete survey has been requested under the Pest Control Act, in cooperation with the Bureau of Indian Affairs. If granted, the survey data will be used by the forest manager of the Reservation to revise the present management plan, to reduce mortality losses and to guide subsequent large-scale control operations for the area.

Fort Valley Experimental Forest

The Division of Forest Pathology cooperated with the Southwestern Forest and Range Experiment Station in a mistletoe reduction study on the Fort Valley Experimental Forest near Flagstaff, Arizona. This is a long-time experiment, designed to show the biological and economic effects of three types of mistletoe treatment, viz:

1. Current Forest Service Practice. Both marking and stand improvement will be in accordance with guides in the Region 3 Timber Management Handbook.
2. Limited mistletoe control. The initial harvest will aim to remove most of the infected saw timber, and stand improvement will be limited to those practices that can be carried out by Forest Service administration under existing allotments and regulations.
3. Unlimited mistletoe control. The objective will be to obtain practical elimination of the parasite in the shortest possible time, irrespective of costs.

The three treatments will be studied on nine 25-acre plots in replicates of three, and, in addition, a 30-acre untreated block will be used as a check. The Division of Forest Pathology will be primarily responsible for observations on the check area. Older control experiments initiated by the Division as far back as 1933 provided information of value in designing the current experiment and should be helpful in guiding its future course.

Western red rot of ponderosa pine in relation to pruning in Arizona and New Mexico

Studies on the role of diseases in relation to pruning in ponderosa pine have been in progress in Arizona and New Mexico since 1947. Analyses of this work were completed in 1951; they show that pruning wounds are unimportant in providing entrance points for infectious diseases. Furthermore, it was found that pruning reduces the hazard of attack by the western red rot fungus, Polyporus anceps, which is responsible for most of the cull and defect in ponderosa pine in South Dakota, New Mexico, Arizona, and probably Colorado.

The fungus attacks recently dead branches of living trees and works through the knots into the heartwood, where it continues to develop for

the life of its host, destroying the wood as it progresses. It cannot become established on pruning or other wounds and the current work shows that even where it had penetrated the knot of a dead branch to a point inside the trunk, on trees up to 55 years of age, the fungus is usually killed if the branch is pruned before the heartwood is invaded. In fifty-year-old stands pruned in 1939, it was found that 10 years later 19 percent of the infected branches contained active rot that would presumably lead to heart rot, whereas in unpruned adjoining stands 73 percent of the infected branches were in this category. In sixty-year-old stands these percentages were 54 and 80, respectively. It appears that pruning as a preventive measure against western red rot is most effective in stands less than 50 years old.

During the year a critical analysis of defect data accumulated since 1913 indicates that red rot losses will probably be greater in young merchantable trees of the future than was the case in the past. One group of observations showed that prior to 1896 the incidence of western red rot did not exceed 3 percent in any 20-year period, whereas in the periods 1896-1915 and 1916-1935 incidence was 5 and 9 percent, respectively.

Survey of rust damage to ponderosa pine on the Apache National Forest, Arizona

At the request of the Forest Service (Region 3 and the Apache National Forest) a survey of the rust fungus Cronartium filamentosum was conducted on the Apache National Forest. This native fungus parasite is endemic throughout most of the ponderosa pine forests of the Southwest but has approached epidemic proportions in certain localities. The rust gradually kills the twigs of infected trees, causing the crown to recede from either the base or the middle until the tree dies.

Infected trees can often be identified by the gap in the crown and by "flagged" twigs that are characteristic of attack by the rust. Red spore cups of the rust develop on the twigs in the summer following the first rains, and vestiges of them can usually be found throughout the year.

The survey indicated that the rust was not serious on the Apache National Forest. Not more than 5 trees per 100 acres were found on a general reconnaissance throughout the ponderosa pine type. However, a dieback causing crown symptoms that might be confused with the rust, except that tell-tale fruiting bodies of the fungus were absent, was found to be quite prevalent. The condition is tentatively considered to be the result of prolonged drouth coupled perhaps with attack by secondary insects.

Stem rot of saguaro

Mortality studies on the Saguaro National Monument indicate that during 1951 about 2 percent of the giant cacti died. This is approximately the observed mortality rate for the past 10 years. Losses are much more severe in the larger plants, the abundance of which is an outstanding feature of the cactus forest on the Monument. Studies have been initiated to determine the extent to which mortality in the large plants is offset by in-growth from smaller plants. A limited amount of study was given to the mass cultivation of saguaros from seed.

Studies of bacteria associated with stem rot of both saguaro and the organpipe cactus were continued. Preliminary tests with suspected vectors were made with no conclusive results.

MISCELLANEOUS DISEASE PROBLEMS IN 1951

Sanitation and fertilization treatments in aspen on the North Rim of Grand Canyon National Park

Ten years ago there was some concern over the future of aspen stands where they had been exposed to excessive trampling. Sanitation and fertilization plots were established at that time in declining aspen stands, some of which had been subjected to excessive trampling, and some which appeared to be naturally regressing. These were re-examined in 1951. In the case of the naturally declining stands, the sanitation measures appeared to have stimulated the growth of the remaining trees, reduced mortality, and hastened the appearance of sprout reproduction but did not appreciably increase resistance to attack by endemic diseases and insects. No improvement was observed in the case of the heavily trampled stands even though they had not been subjected to excessive use during the 10-year period 1941-1951. Heavy applications of fertilizer, if applied before serious decline begins, appear to increase the vigor of the stand and reduce disease and insect attacks. Presumably irreparable trampling damage might be avoided by restricted use followed by fallow years with perhaps some fertilization and sanitation measures.

Mistletoe seed germination

Germination-infection experiments with seed of the ponderosa pine dwarfmistletoe were continued during the year at the Fort Valley Experimental Forest. The results to date suggest that seeds of the parasite tend to germinate immediately after ripening, provided they receive ample moisture. Thus far, seeds that have remained dormant for more than a few weeks have failed to germinate. Of about 900 seeds planted on small ponderosa pines, only about 8 percent appeared to have made a successful contact with their hosts, another 14 percent germinated but died, and the remainder died without germinating.

Trunk canker of aspen

Investigations were initiated to determine the cause of a canker disease that is prevalent on aspen west of the Continental Divide, notably on the Routt and White River National Forests of Colorado. Cultures of fungi associated with the disease have been studied and found to be different from those associated with aspen canker in the Lake States and the East.

Wood-staining fungi

Studies were made of several staining fungi associated with beetle-killed spruce and Douglas-fir lumber in Colorado. The spruce organism was described as a new species, Leptographium engelmanni Davidson. One of the lumber stains was described as a new variety, Endoconidiophora coerulescens var. douglasii Davidson, and the other was found to be Ophiostoma piceae, a European species being reported for the first time in the United States.

APPENDIX

Forest Pathology Field Stations in the Rocky Mountain Regions:

Albuquerque, New Mexico - Room 310 Post Office Building,
P. O. Box 523. Dr. Lake S. Gill, Senior Pathologist
in Charge.

Fort Collins, Colorado - Department of Botany and Plant
Pathology, Colorado A. & M. College. Dr. Ross W.
Davidson, Senior Pathologist in Charge.

Missoula, Montana - Room 3025 Federal Building,
P. O. Box 530. Mr. Charles D. Leaphart, Assistant
Pathologist in Charge.

Spokane, Washington - South 157 Howard Street
Inland Empire Research Center, U. S. F. S.
Mr. Donald P. Graham, Agent in Charge

Tucson, Arizona - University of Arizona, 216 Stadium Building
P. O. Box 4006. Mr. William C. Bryan, Agent in Charge

Mistletoe Surveys and Control

United States Department of Agriculture

Forest Service

Southwestern Region, Albuquerque, New Mexico

Southwestern Forest and Range Experiment Station,

Tucson, Arizona

United States Department of the Interior

National Park Service

Region 3 - Santa Fe, New Mexico

Grand Canyon National Park, Arizona

Bryce Canyon National Park, Springdale, Utah

Bureau of Indian Affairs

Area Director, Albuquerque, New Mexico

Mescalero-Apache Indian Reservation, Mescalero, New Mexico

Stem Rot of Saguaro

University of Arizona

United States Department of the Interior

National Park Service

Region 3, Santa Fe, New Mexico

Saguaro National Monument, Arizona

Principal cooperating agencies

Pole Blight of Western White Pine

United States Department of Agriculture

Forest Service

Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana

Northern Region, Missoula, Montana

Bureau of Entomology and Plant Quarantine

Forest Insect Laboratory, Coeur d'Alene, Idaho

Office of Blister Rust Control, Spokane, Washington

University of Idaho, School of Forestry, Moscow, Idaho

Dominion Laboratory of Forest Pathology, Victoria, B. C.

Washington State College, Department of Plant Pathology, Pullman, Washington

North Idaho Forestry Association, Lewiston, Idaho

Clearwater Timber Protective Association, Orofino, Idaho

Deterioration of beetle-killed spruce

United States Department of Agriculture

Forest Service

Rocky Mountain Region, Denver, Colorado

Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado

Bureau of Entomology and Plant Quarantine

Forest Insect Laboratory, Fort Collins, Colorado

Colorado A. & M. College, Fort Collins, Colorado